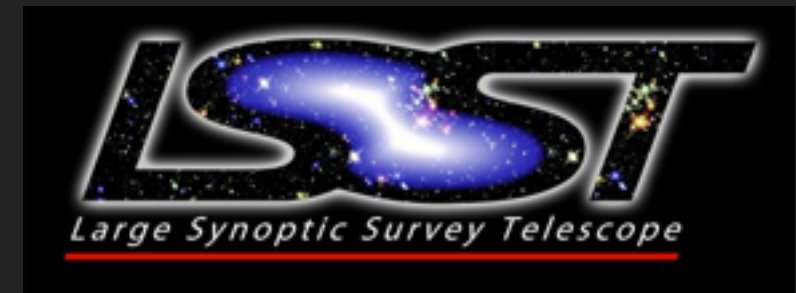


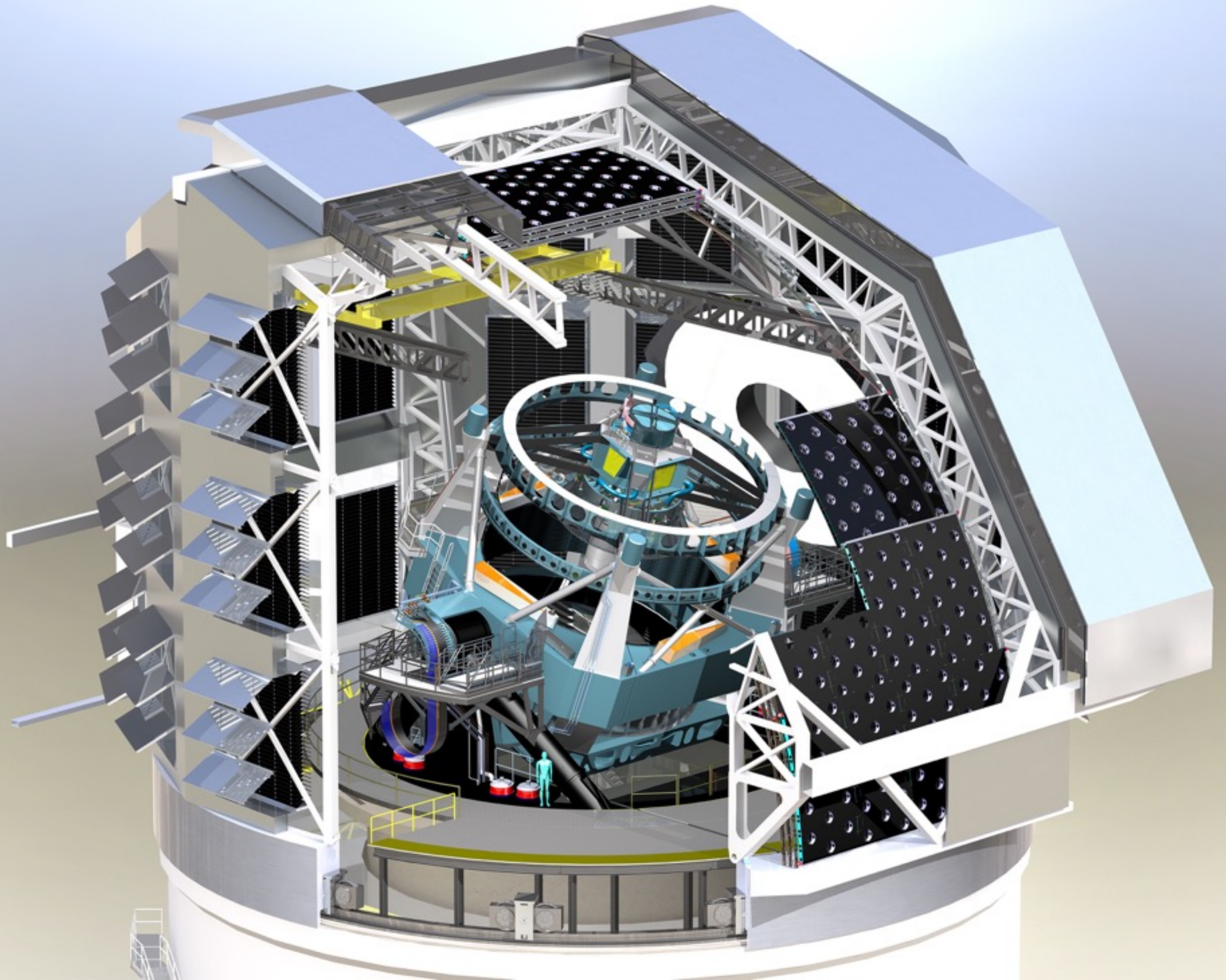
PETER MELCHIOR, JIM BOSCH, ROBERT LUPTON (PRINCETON)

WFIRST & LSST

LSST OVERVIEW



- ▶ 8.4m mirror, 9.6 sq. deg FoV, fast moving support structure
- ▶ 3.2 Gpixel camera, 200 μm deep depleted CCDs, 2 s readout time
- ▶ 18,000 sq. deg in 6 band (ugrizy) to $r\sim 27$ ($r\sim 28$ in deep fields)
- ▶ 2x15 s visits, entire visible sky in 2-3 days
- ▶ 15 TB/night, 100 PB for whole survey
- ▶ 2020 first light, survey operations start 2022/23





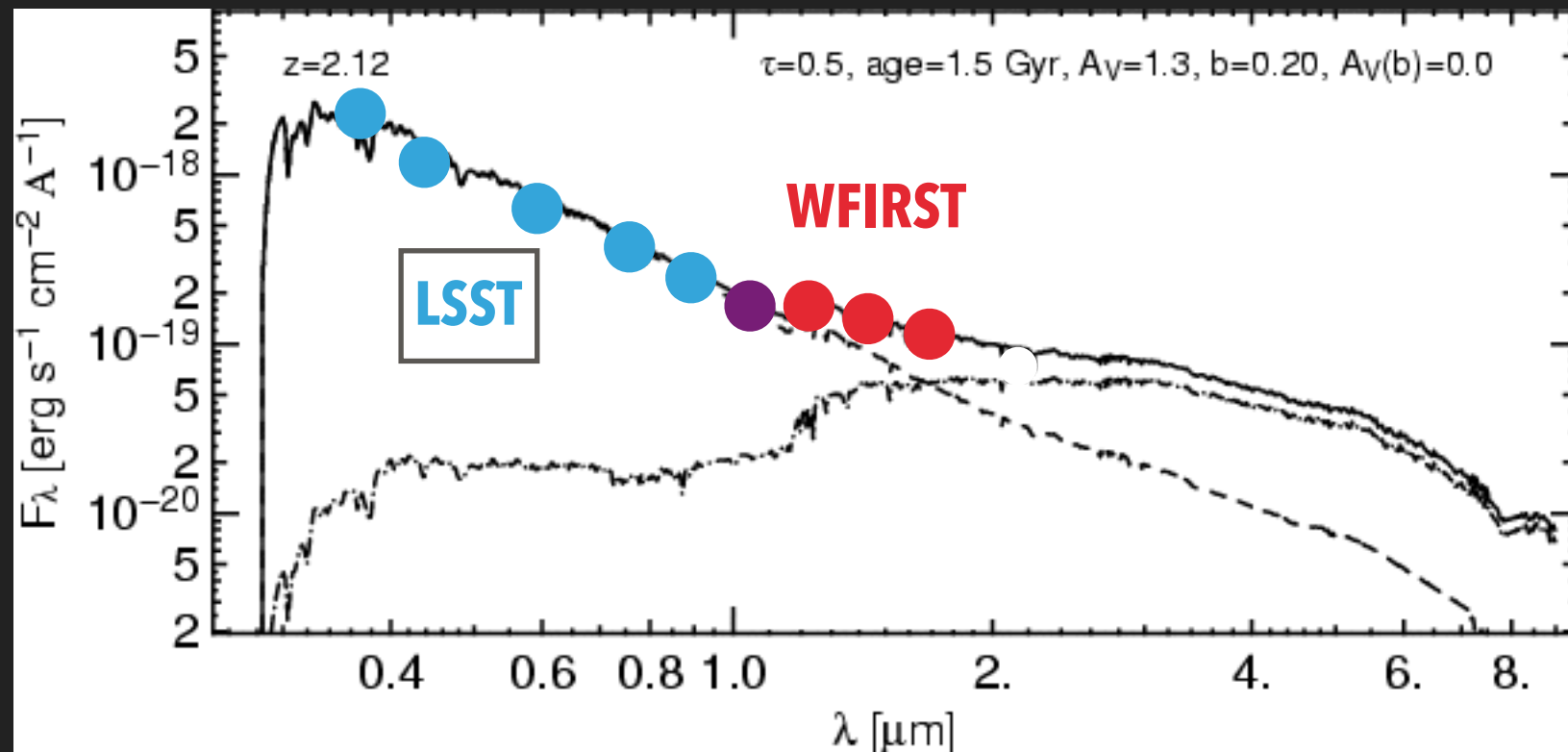


THE CASE FOR GROUND & SPACE

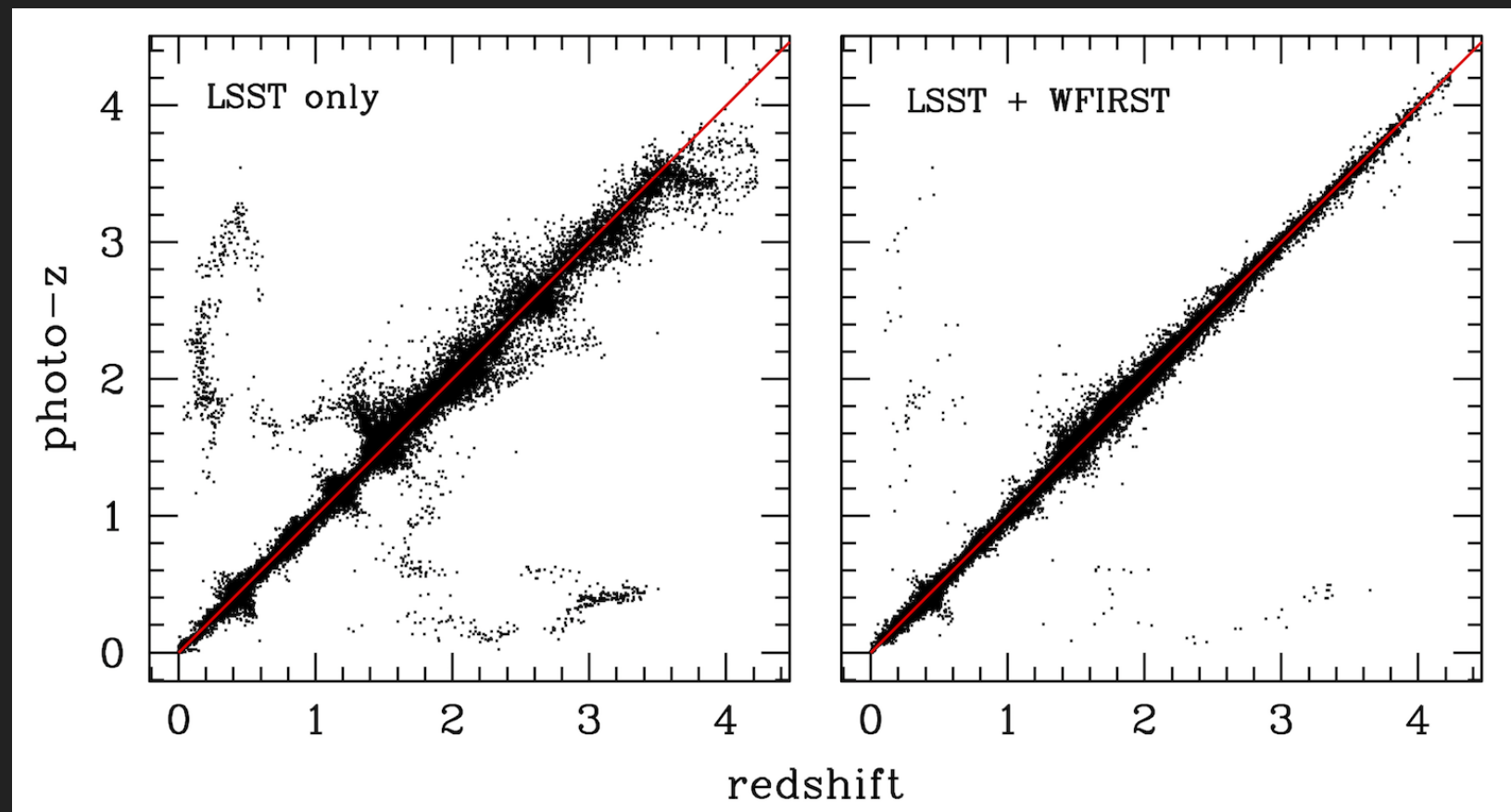
THE CASE FOR GROUND & SPACE

CLASH WFC3/IR data, image by Dan Coe

SYNERGIES FOR PHOTOMETRY AND SHAPES



from Elsner (2008)



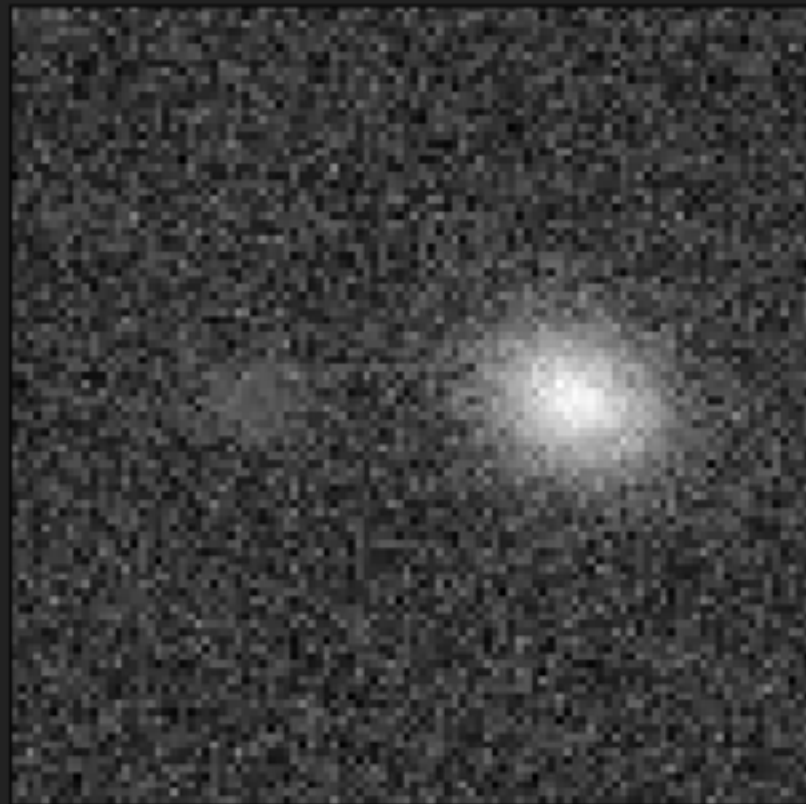
from Jain et al. (2015)

A SIMPLE TEST CASE FOR SHAPE & PHOTO-Z

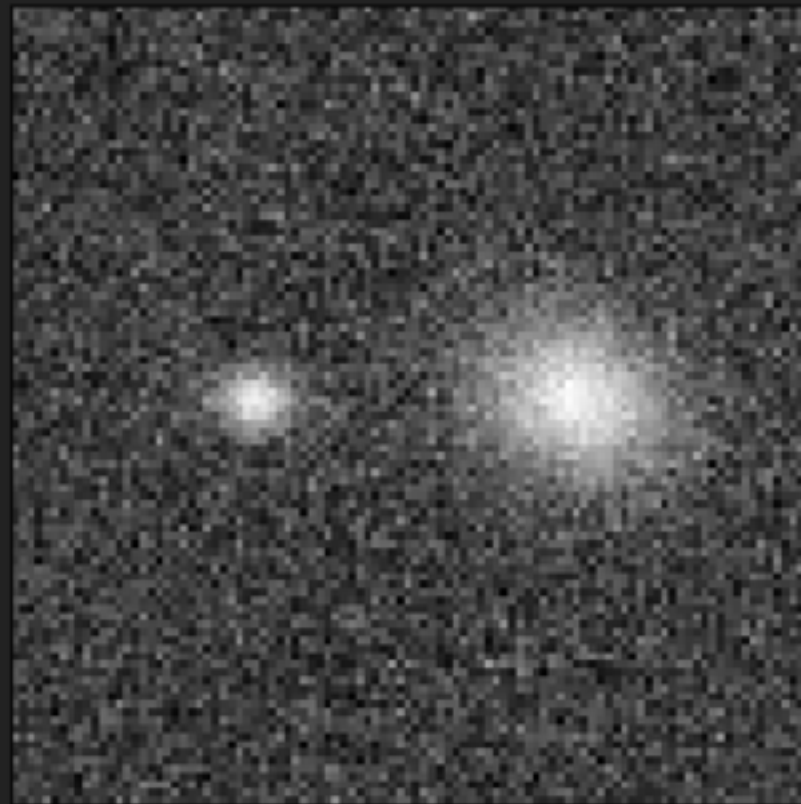
- ▶ single Sersic-type galaxies, convolved with constant Gaussian PSF
- ▶ SEDs and morphologies from late-type and early-type galaxy
- ▶ simplistic redshifting model



INDEPENDENT MEASUREMENTS



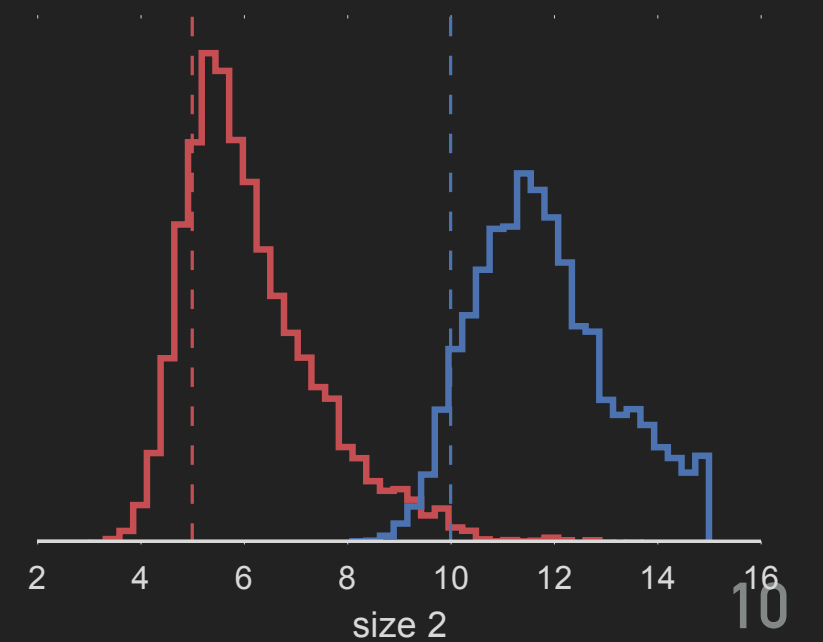
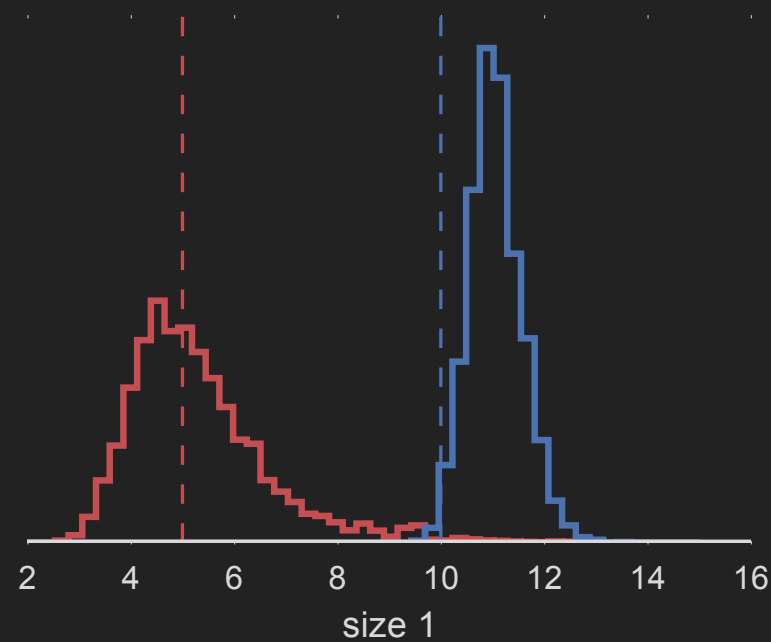
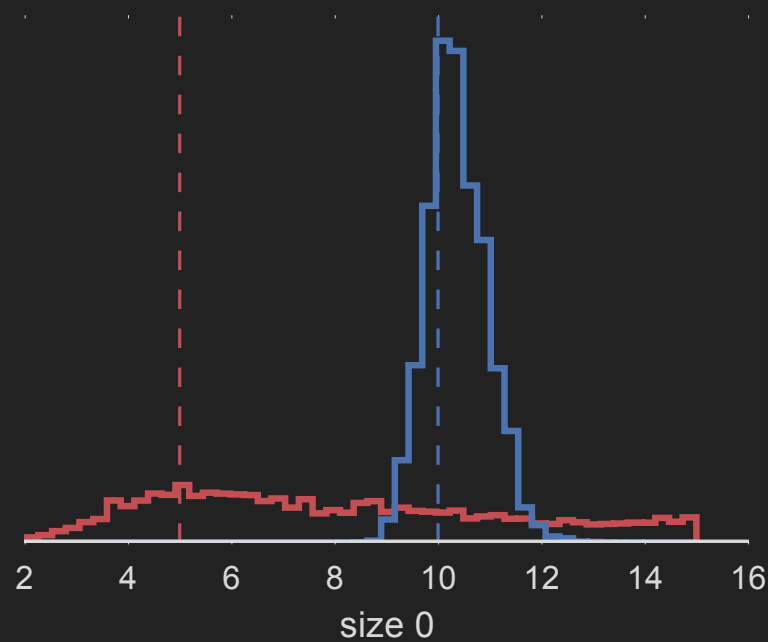
g band



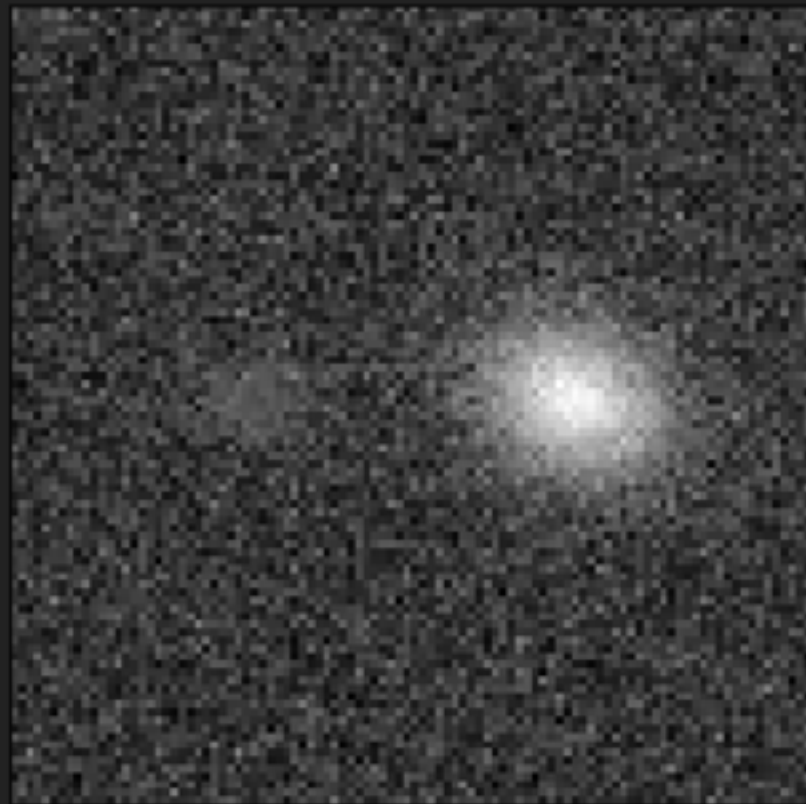
r band



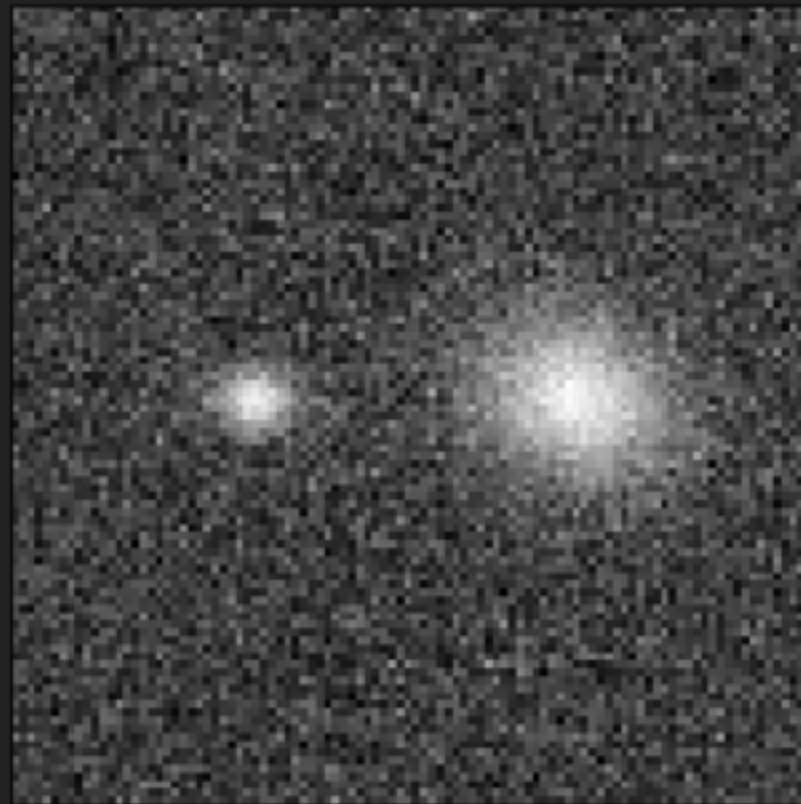
i band



INDEPENDENT MEASUREMENTS



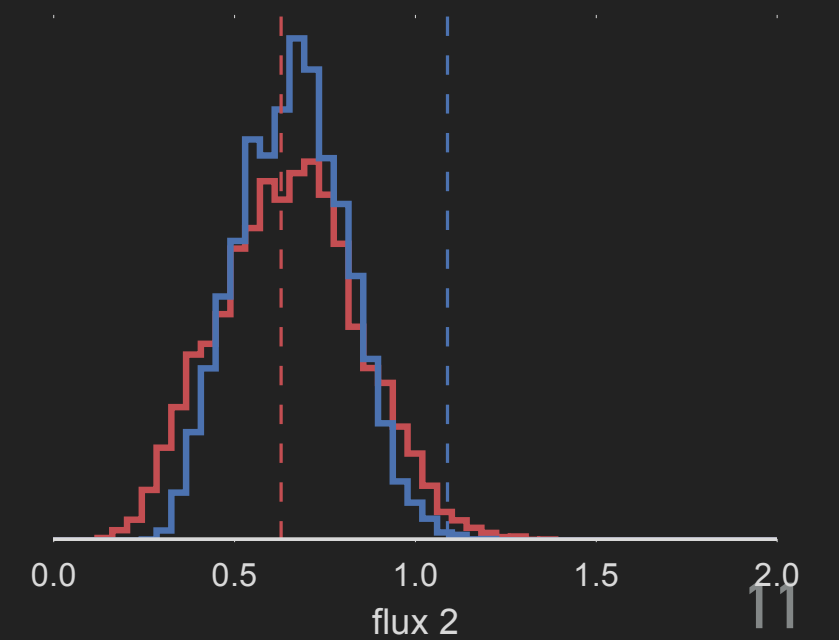
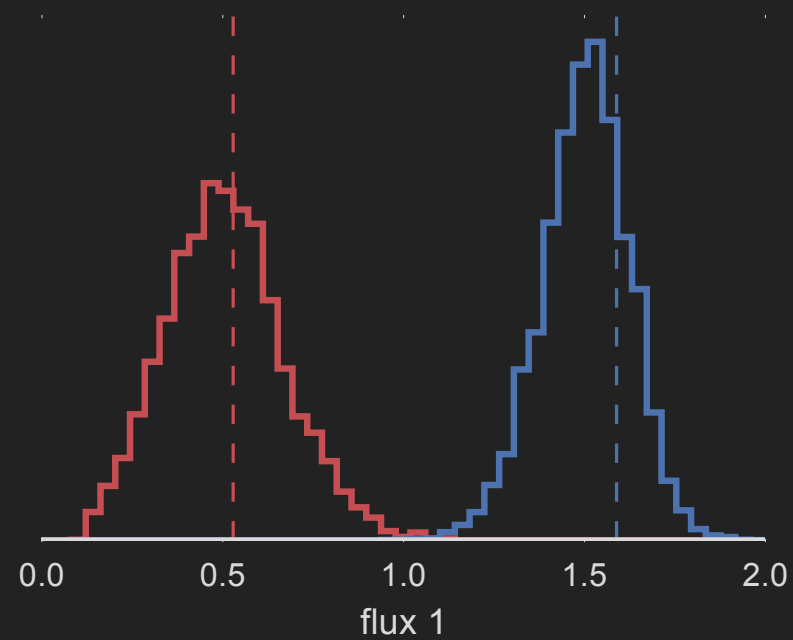
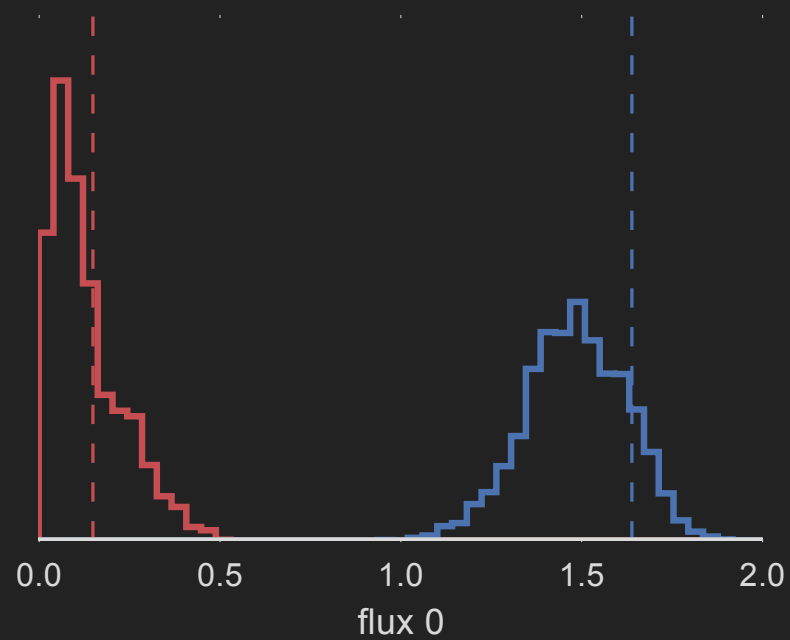
g band



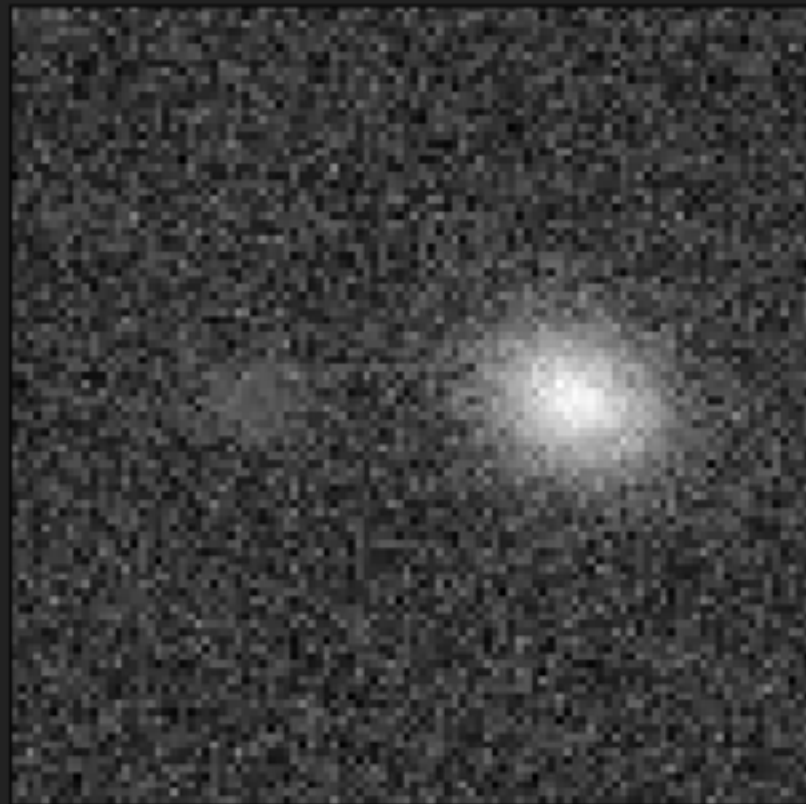
r band



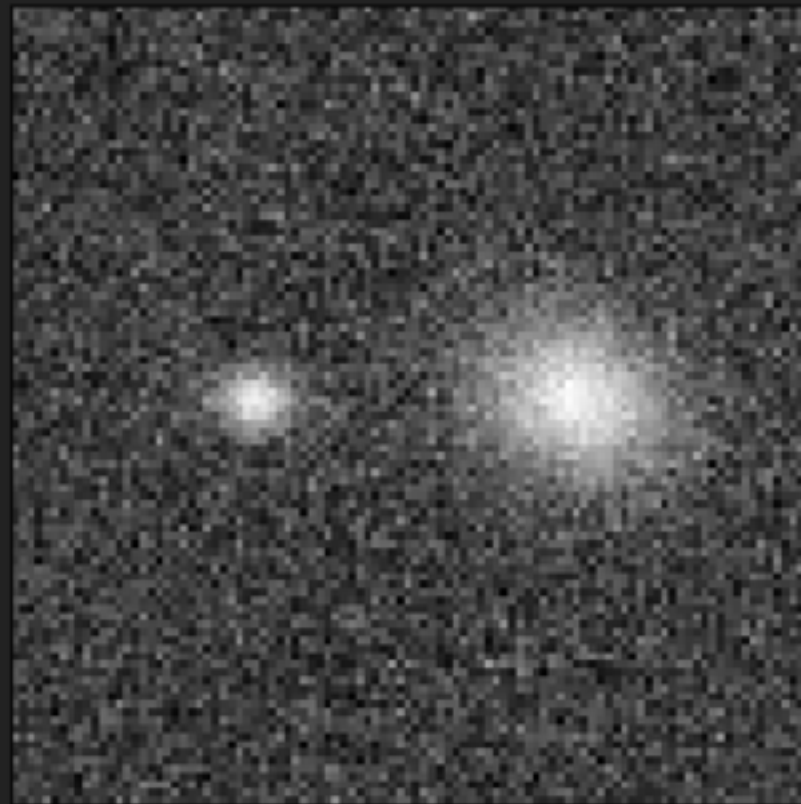
i band



MATCHING “APERTURES”



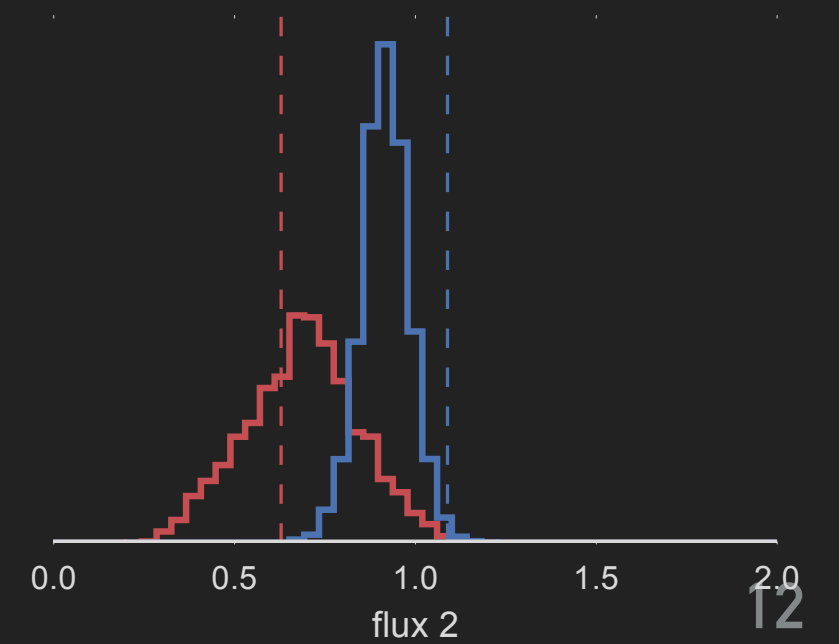
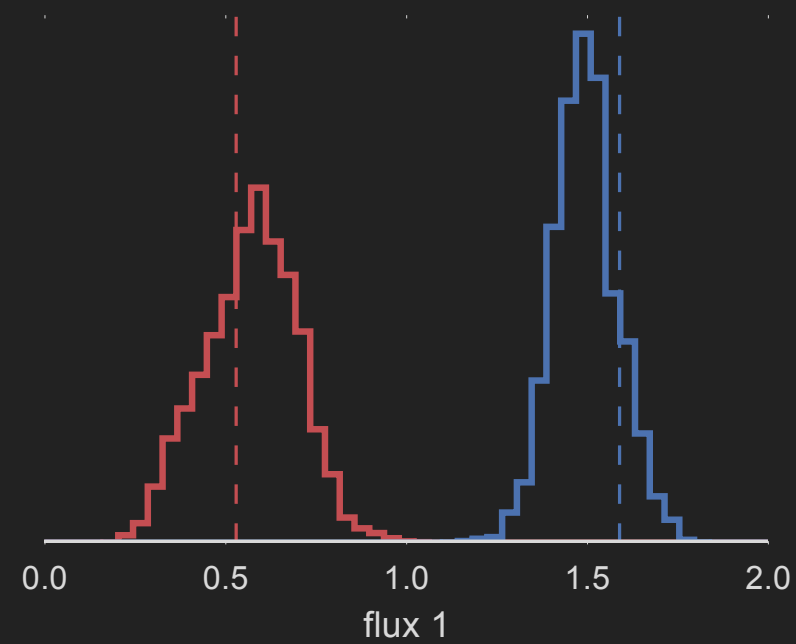
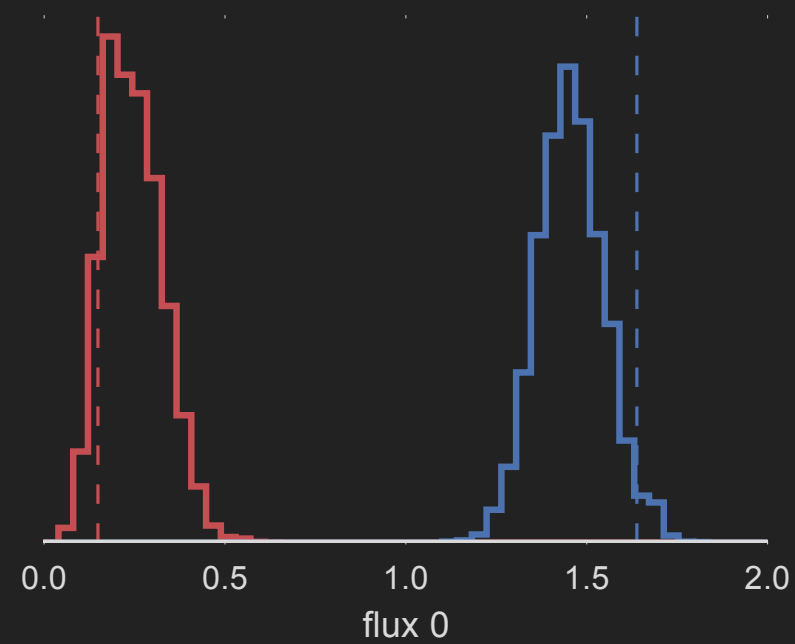
g band



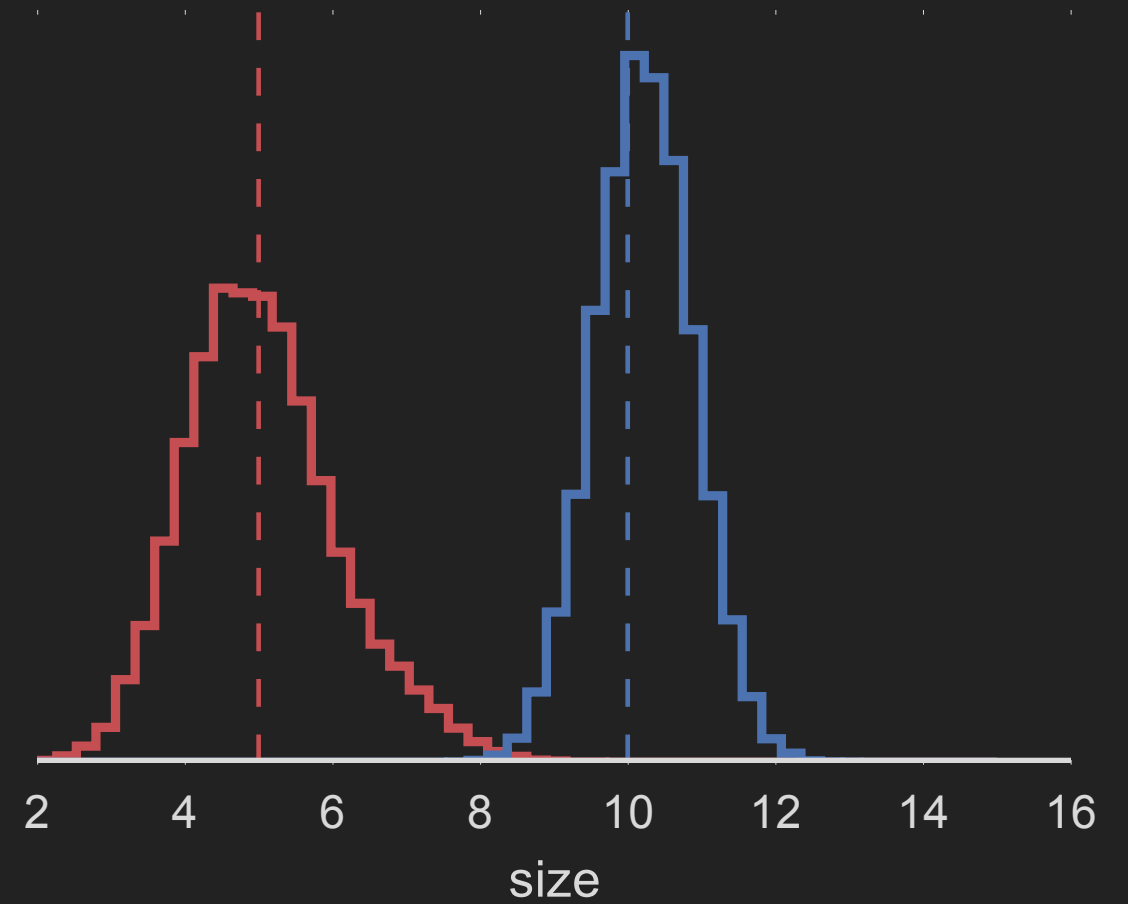
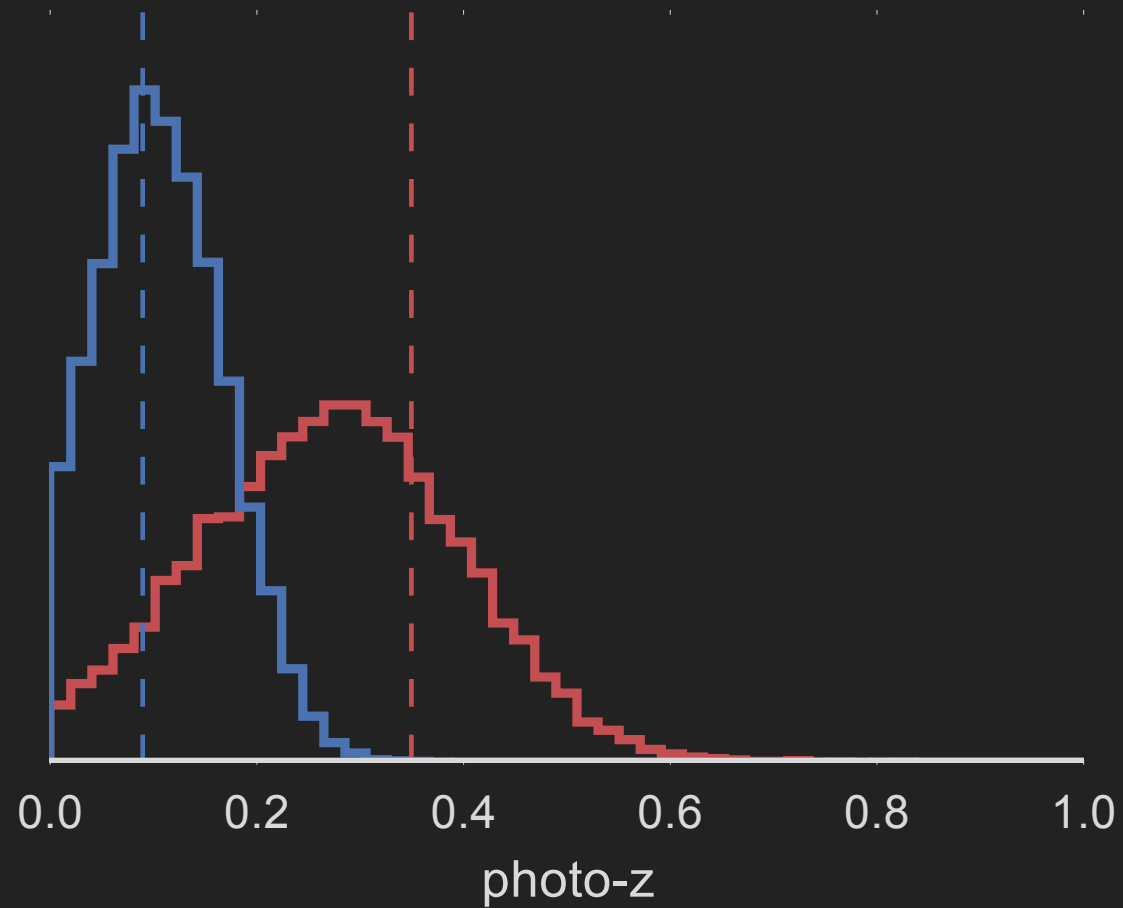
r band



i band

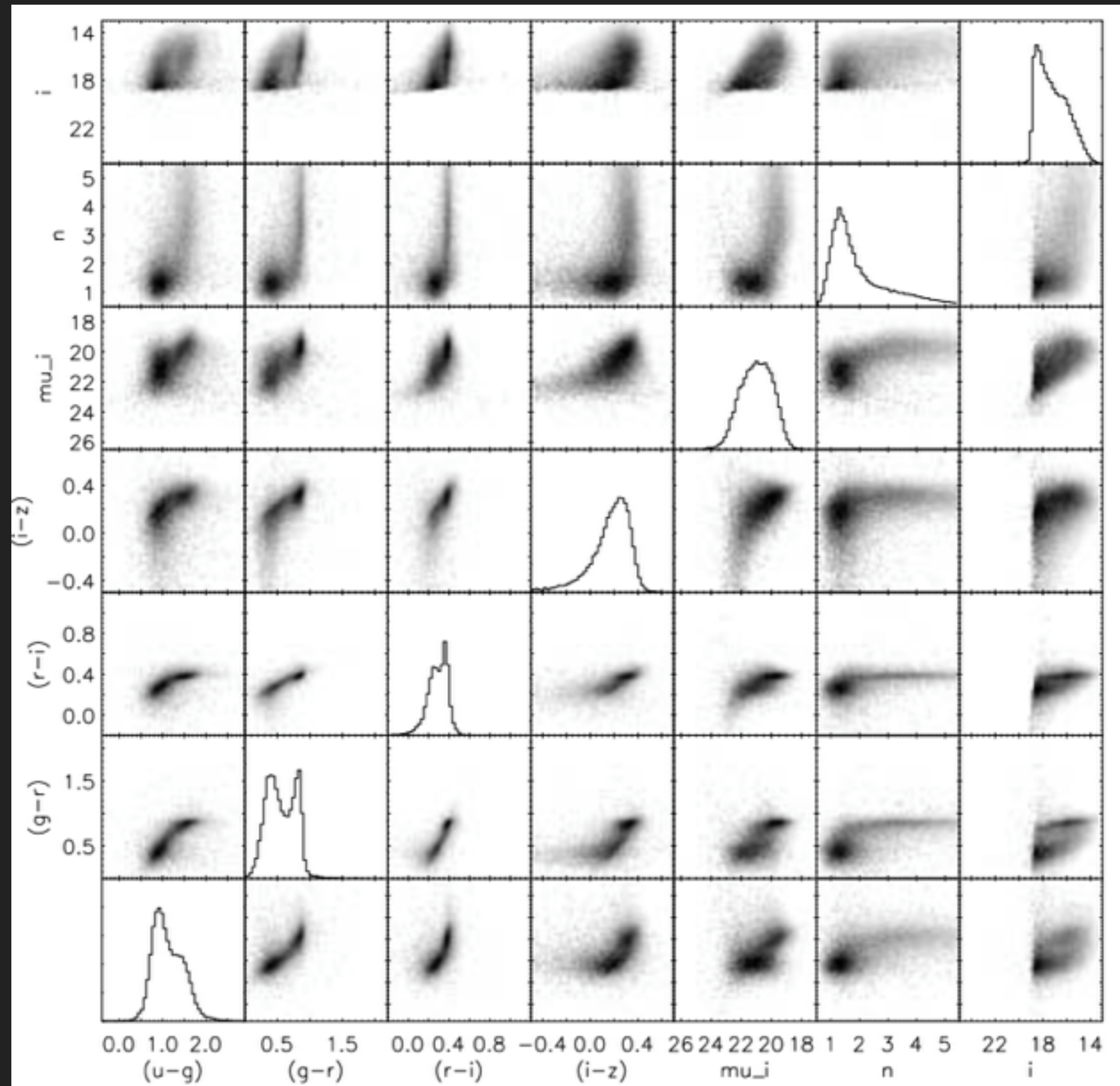


MATCHING “APERTURES”



MORPHOLOGY FOR PHOTO-Z'S

- ▶ Wray & Gunn (2008)
- ▶ joint galaxy relations exist (at low z)
- ▶ photo- z 's can be improved by factor ~ 1.5 with
 - ▶ luminosity
 - ▶ Sersic index
 - ▶ surface brightness



JOINT PHOTOMETRY AND SHAPES

$$\begin{aligned} p(\theta, z) &= p(\theta \mid z) p(z) \\ &= \sum_k p(\theta \mid z, k) p(z \mid k) p(k) \end{aligned}$$

JOINT PHOTOMETRY AND SHAPES

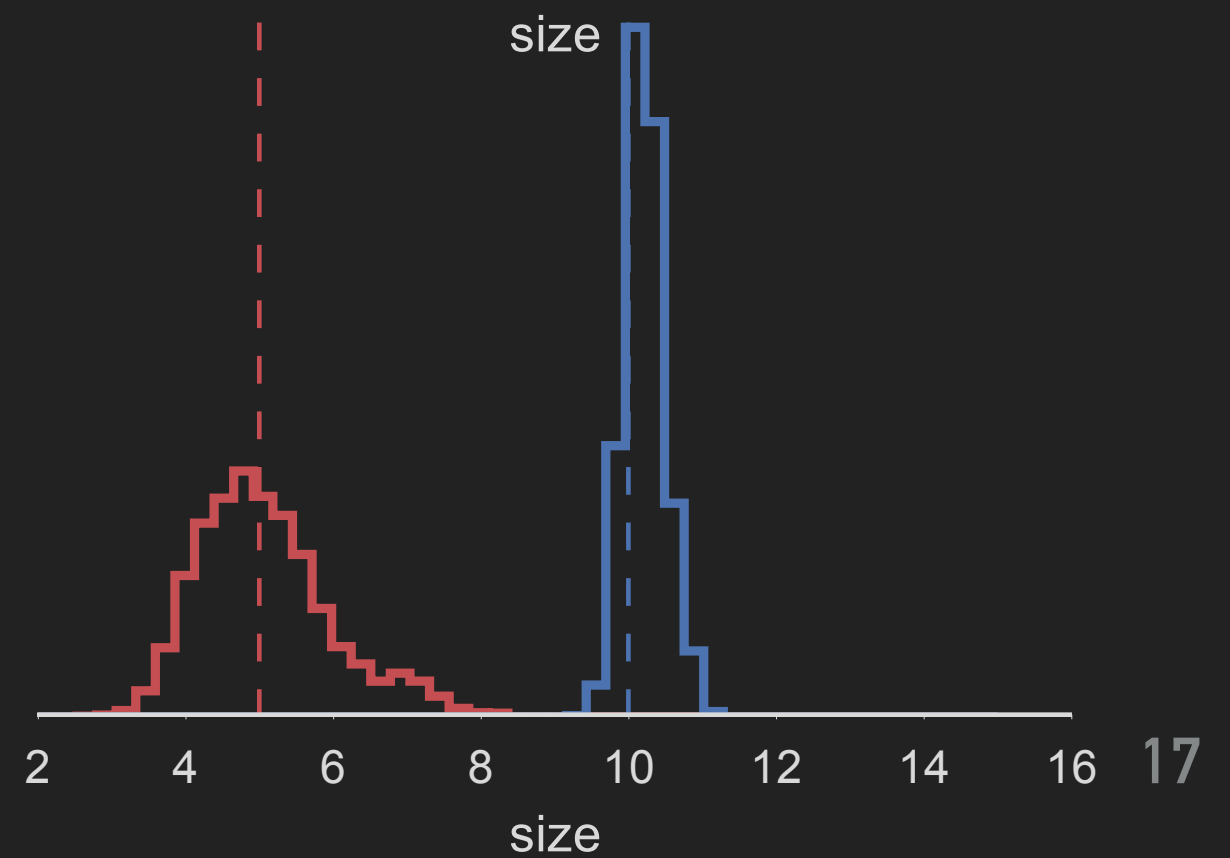
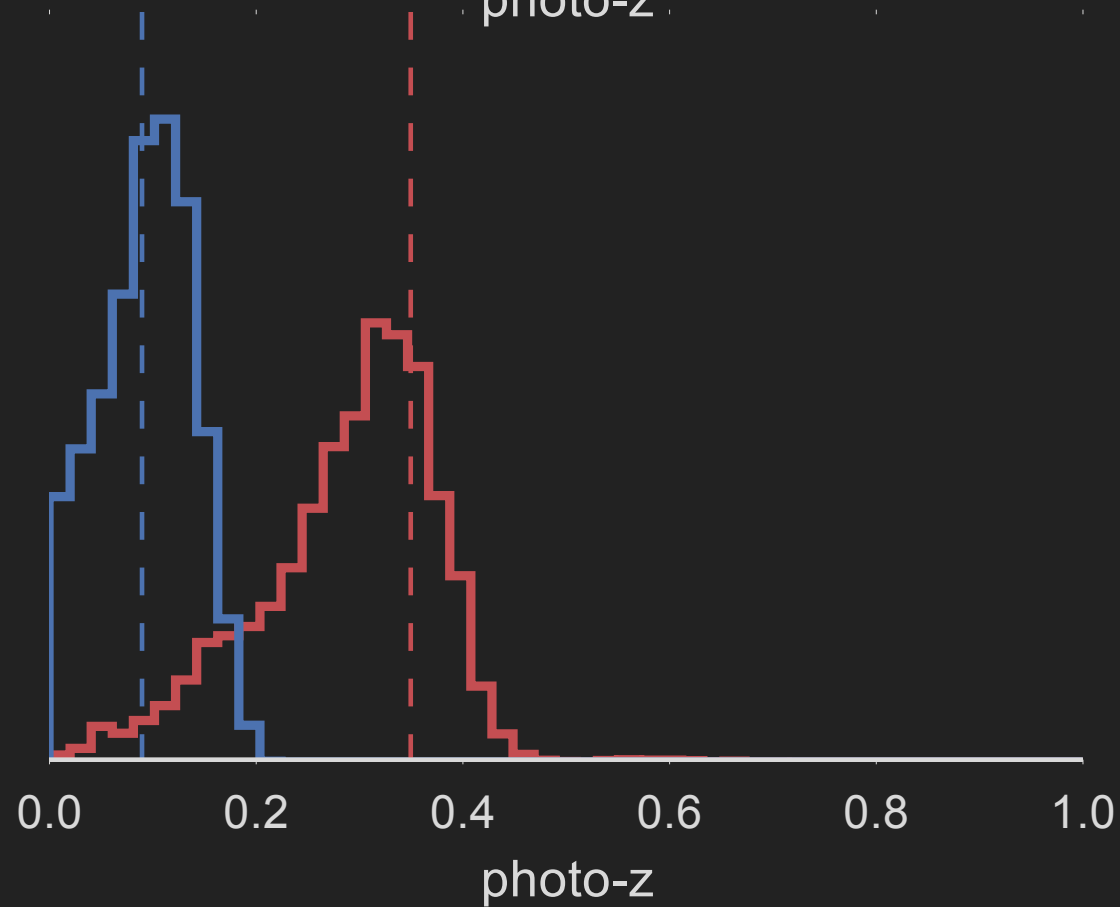
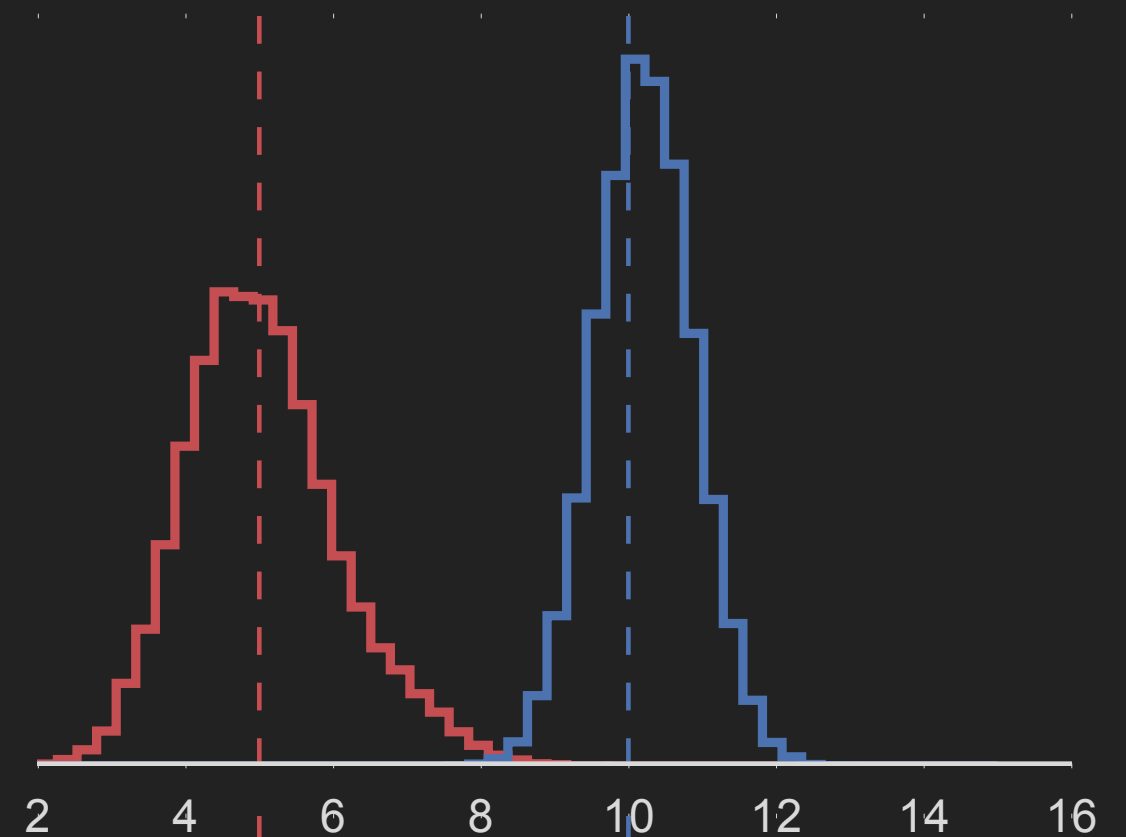
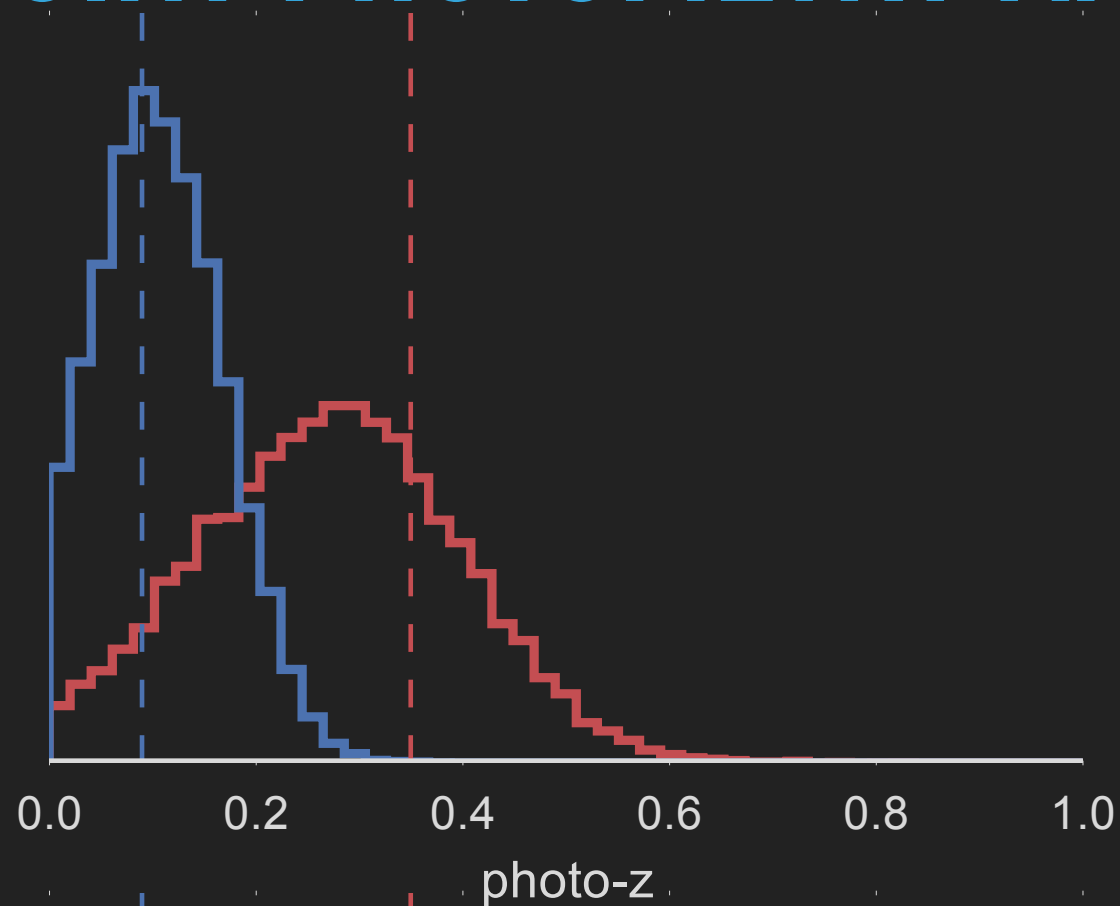
$$p(\theta, z) = p(\theta \mid z) p(z)$$

$$= \sum_k p(\theta \mid z, k) p(z \mid k) p(k)$$

$$p(\theta \mid z, k) = \mathcal{N}(\theta_k(z), \Sigma_k(z))$$

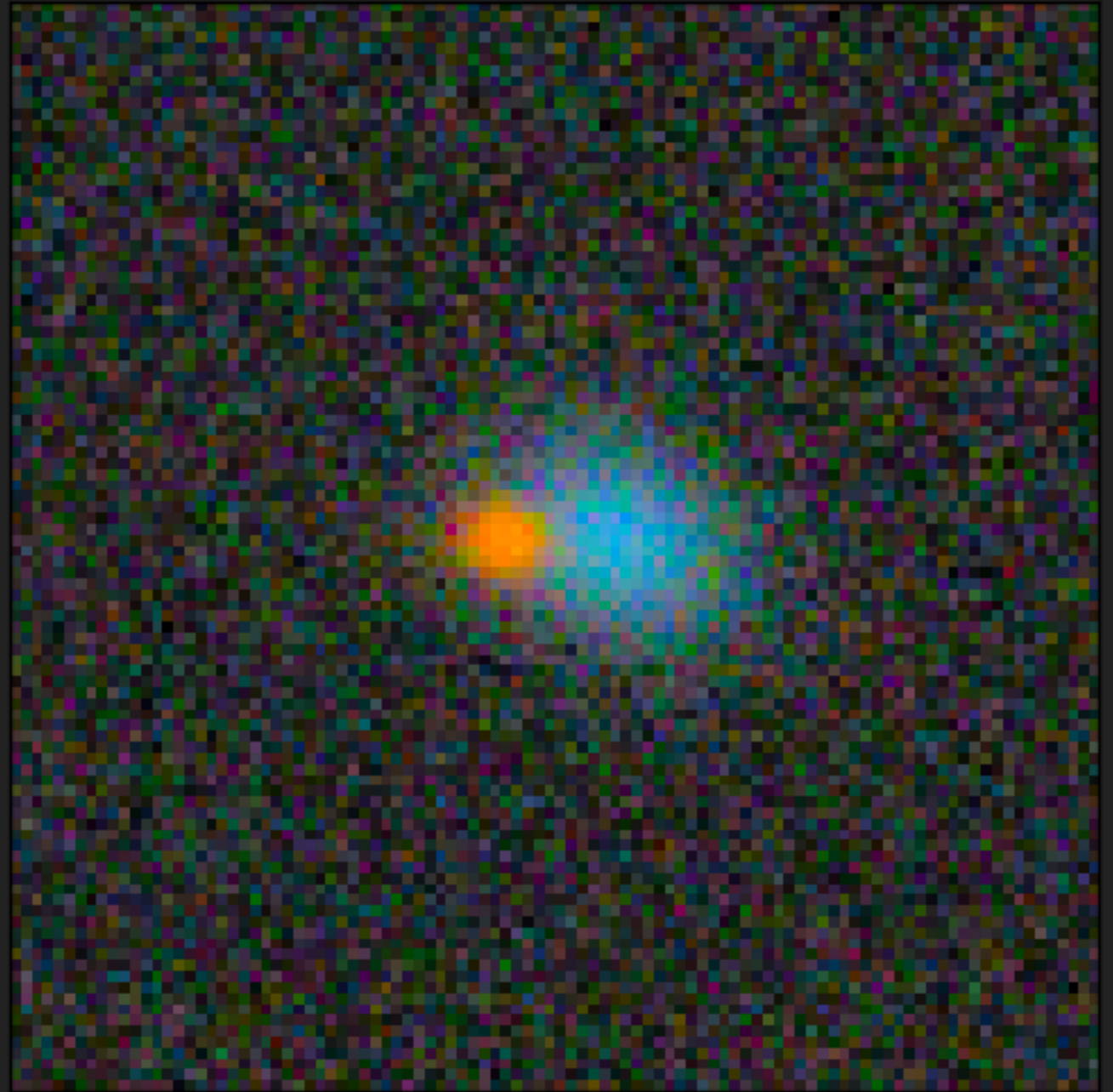
$$\theta_k(z) = (r_k(z), L_k(z), n_k, e_k, \text{SED}_k)$$

JOINT PHOTOMETRY AND SHAPES

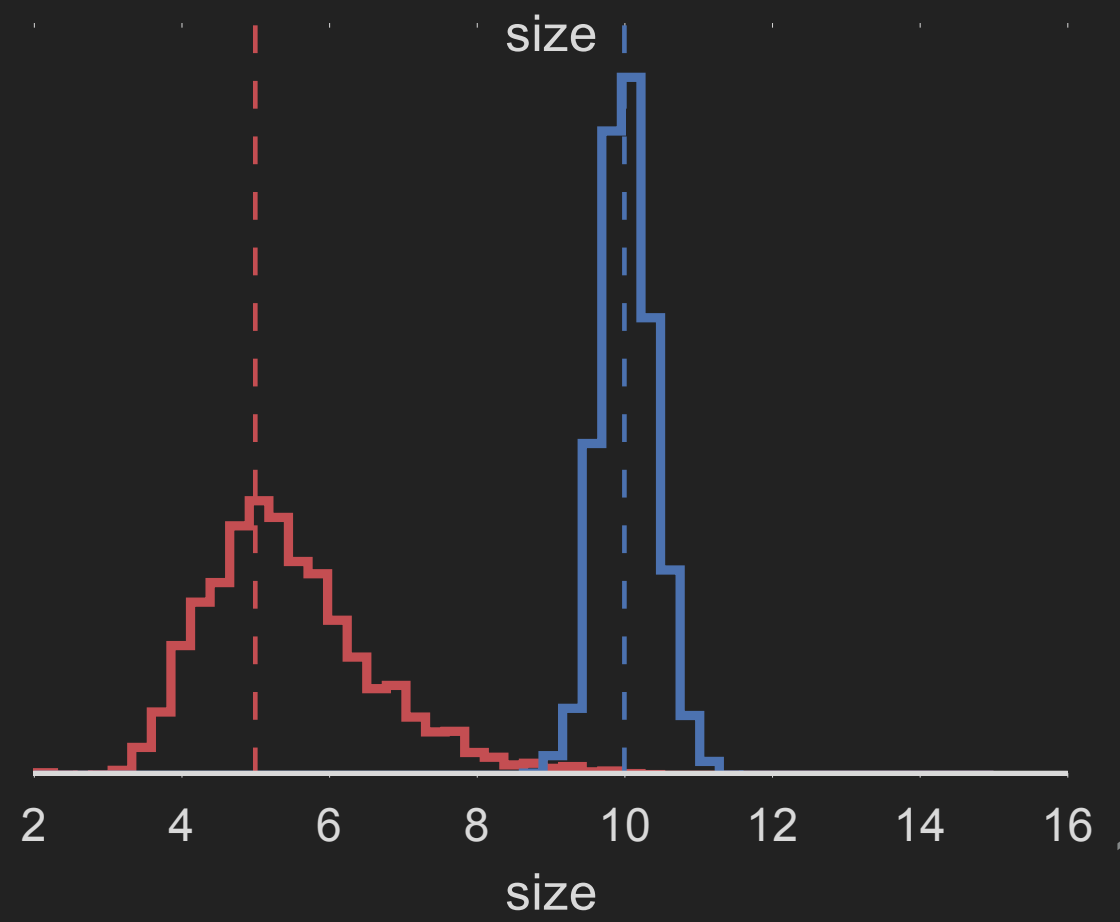
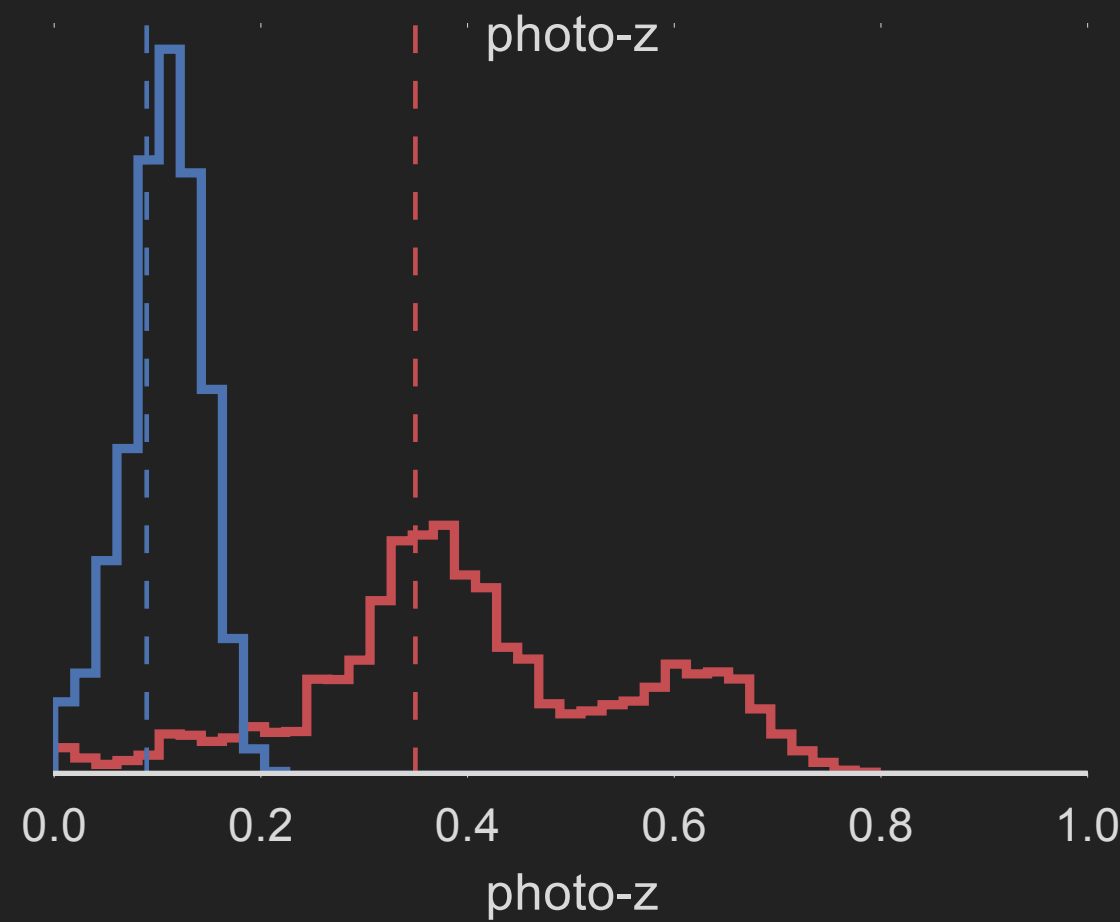
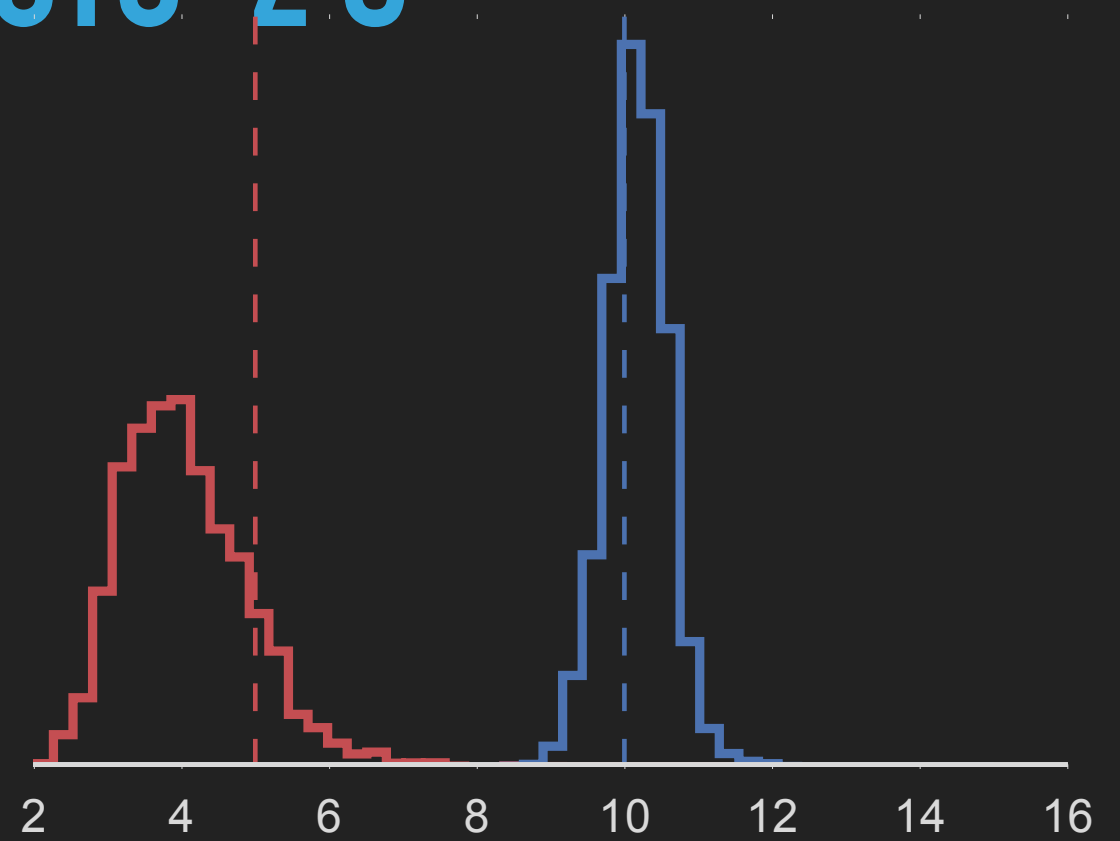
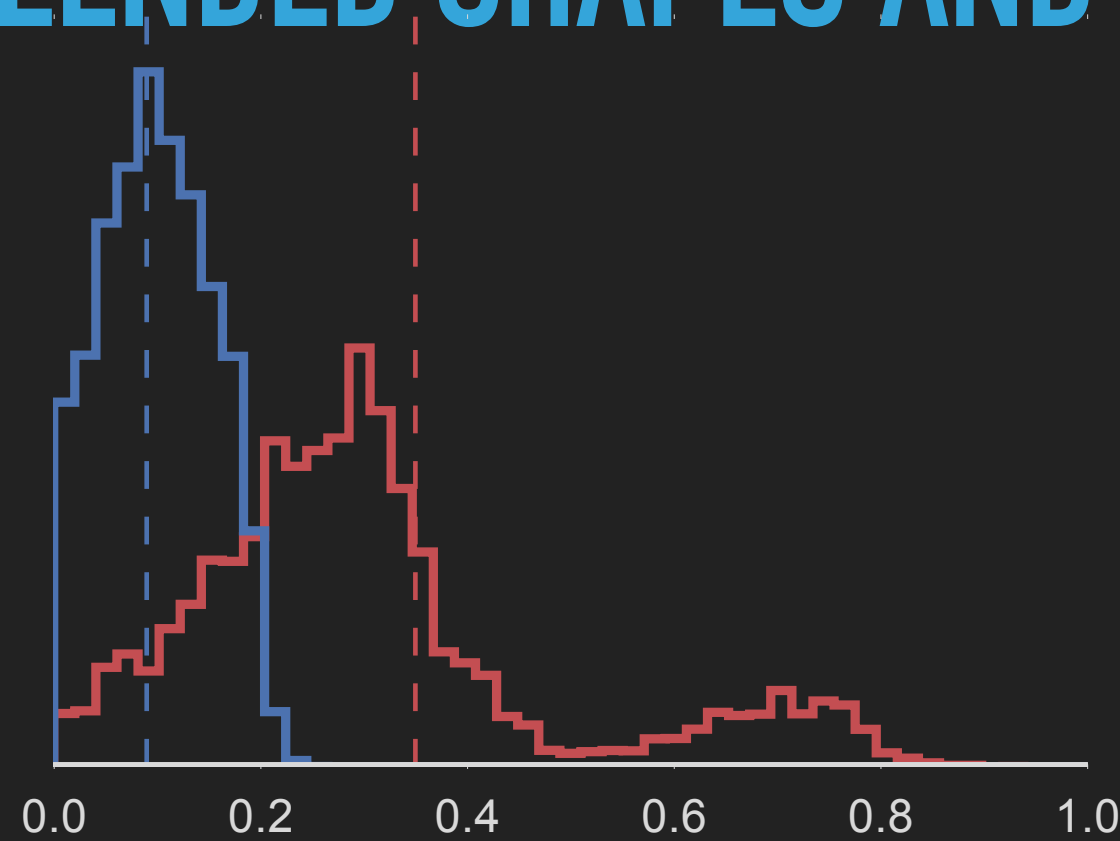


BLENDING

- ▶ Galaxy models have many parameters
- ▶ In blended cases: too many!



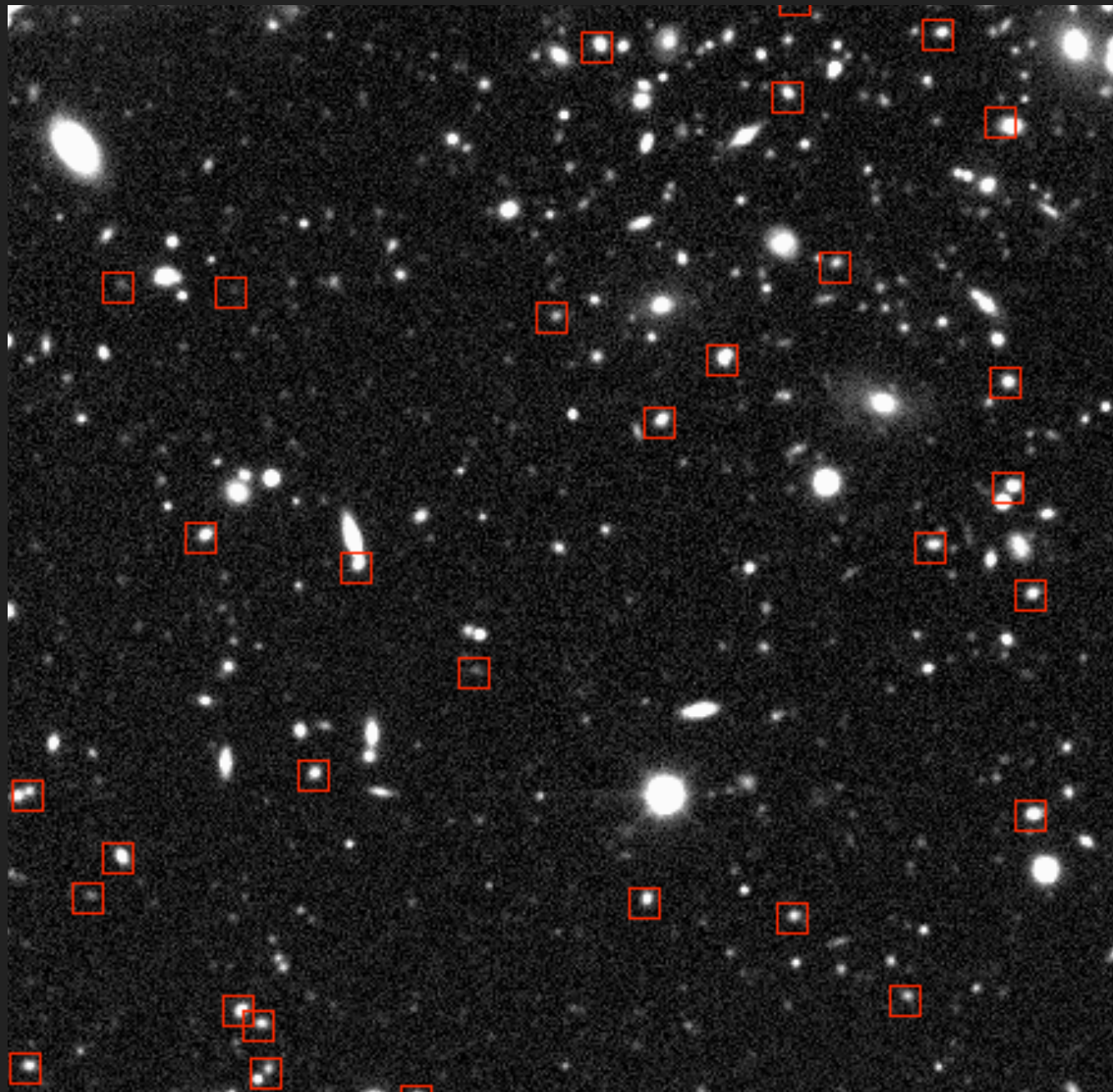
BLENDING SHAPES AND PHOTO-Z'S



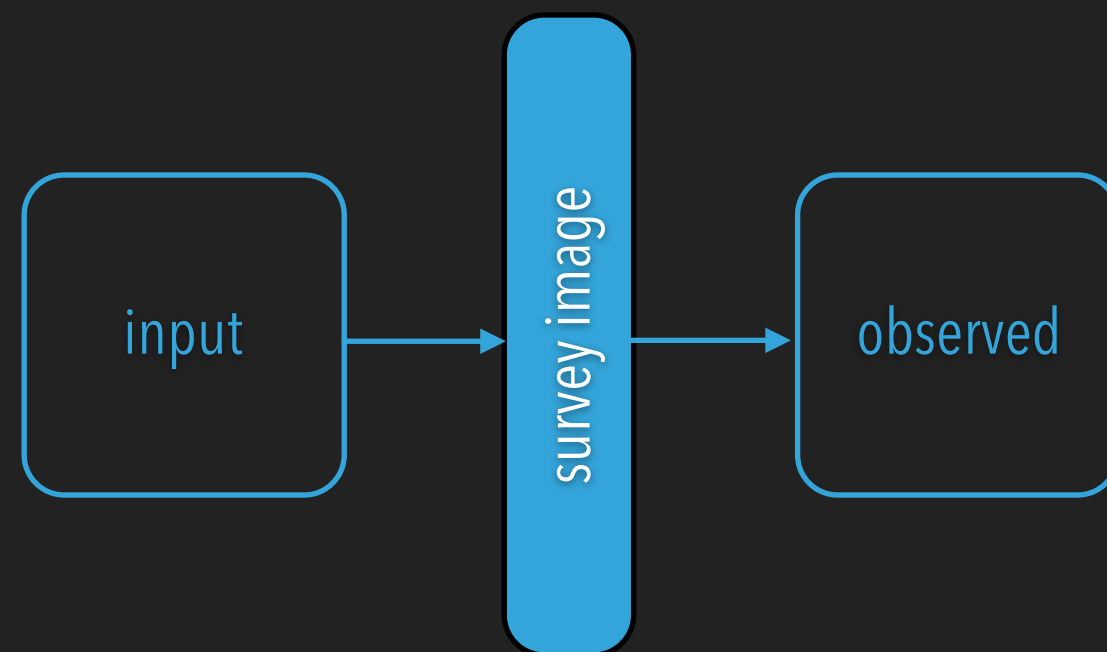
JOINT PROCESSING OF LSST & WFIRST

- ▶ Minor addition to LSST computing budget
- ▶ Joint detection ("Kaiser coadds")
- ▶ Joint measurements: particularly important to marginally resolved galaxies (e.g. bulge components)
- ▶ WFIRST: much better photo-z
- ▶ LSST: much better shapes in HLS overlap area
Update of galaxy priors for area outside of HLS:
S/G, observability, blending

BACKUP SLIDES



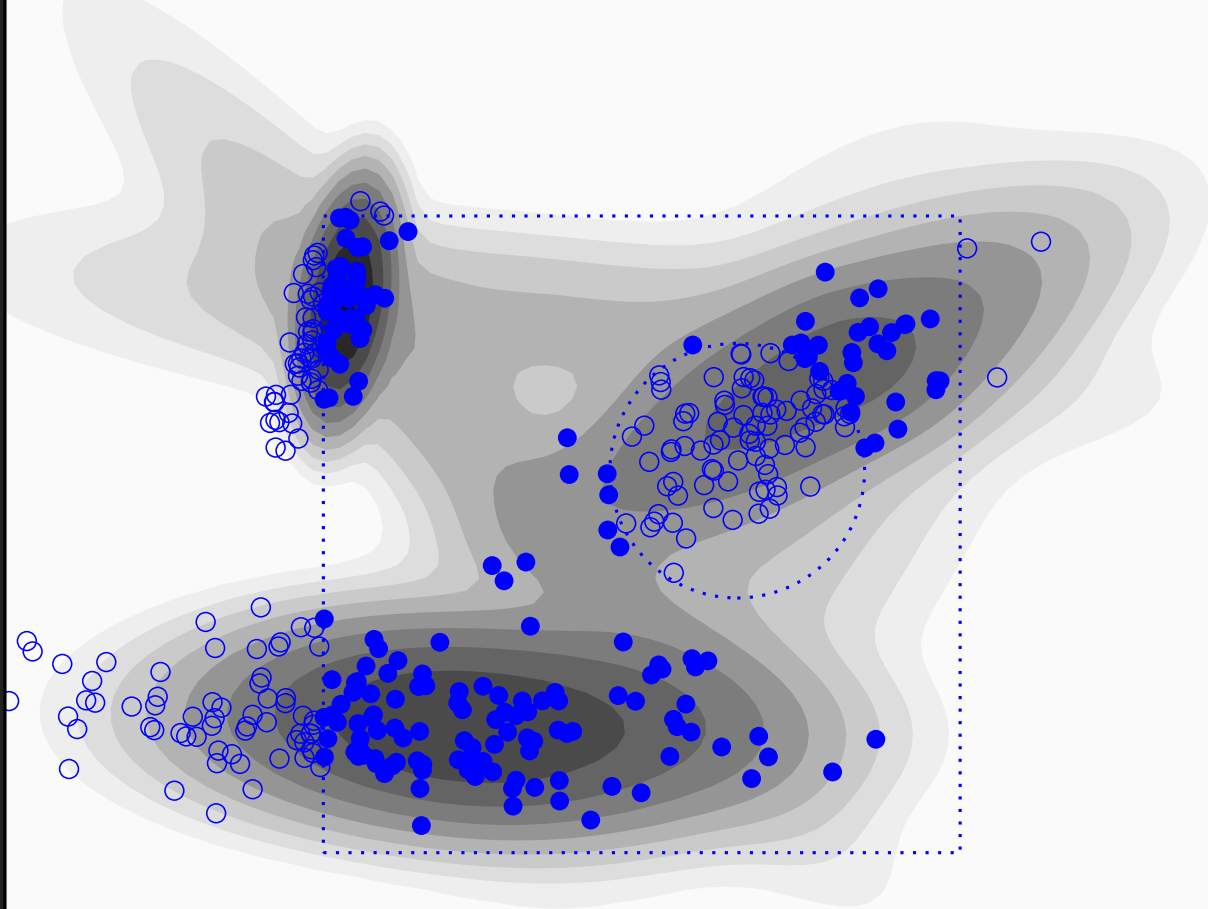
Inserting mock galaxies and stars into survey images



GMM WITH UNOBSERVED DATA

MELCHIOR (IN PREP.)

$\log \mathcal{L} = -4.647$



$\log \mathcal{L} = -4.100$

